Investing in Innovation: What Pays?

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An Economist’s Prophecies

“It’s déjà vu All Over Again!”
“I Really Didn’t Say Everything I Said”
“When You Come to A Fork in The Road – Take It!”
“The Future Ain’t What it Used to Be!”

Yogi Berra
Clark is Optimistic about the Pear Industry!

ARE YOU? AND IF SO, WHY?

1. Outside of the pear industry, nobody is talking about pears!
   - Other crops that are more exciting
     Hazelnuts, Blueberries, Apples, Cherries
   - Time to reach full production (ROI)
   - New Varieties?
   - Rootstocks?
2. Grown mainly in the western U.S.
3. Acreage is fairly steady
Clark is Optimistic about the Pear Industry!

4. Supply of pears are steady, worldwide
   Europe supply is flat if not declining
   China growing Asian Pears, European pear?

5. Middle class households are growing, worldwide

Challenges for the Pear Industry!

1. Food safety
2. Regulations
3. Trade issues
   - Russia
4. Value of the dollar
   - Canada & Mexico (biggest importers of your pears)
5. Consumption (steady)
Data compiled in 2010 by a third party source, The Perishables Group.

U.S. Live Births 1905–2005

<table>
<thead>
<tr>
<th>Generation</th>
<th>Number of Births (in millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GI Generation</td>
<td>56.6 million</td>
</tr>
<tr>
<td>Silent Generation</td>
<td>32.1 million</td>
</tr>
<tr>
<td>Baby Boomers</td>
<td>79.2 million</td>
</tr>
<tr>
<td>Generation X</td>
<td>89.9 million</td>
</tr>
<tr>
<td>Generation Y</td>
<td>140 million (est. 2005)</td>
</tr>
</tbody>
</table>

The typical pear consumer

- 35-44 years old
- $50,000+ household income
- 68% eat pears out of hand
- 50% impulse purchase
- Buys pears a few times per month
- Basket size is 1.5 - 2x larger than non-pear consumers

Data compiled in 2010 by a third party source, The Perishables Group.
### Top Fruit

1. Apples  
2. Bananas  
3. Grapes  
4. Strawberries  
5. Oranges  
6. Avocados  
7. Blueberries  
8. Cherries  
9. Watermelon  
10. Peaches  
11. Pears

_Neilson Perishables Group FreshFacts_

### Challenges for the Pear Industry!

6. Consumer’s want to know about their food  
7. Labor – Supply and Cost
Mechanical Harvesting in Precision Horticulture


Mechanical Harvesting in Precision Horticulture

Minimum Wage Rates – Projected and Actual – for Washington State, 2004 to 2025
**Research is Advancing Fruit Quality and Quantity!**

Controlling vigor and increasing fruit set
- chemical
- root pruning
- Retain

New varieties (fireblight resistance?)

Promising rootstocks but perhaps longer-term goal
What can UAS technology do for your business?
Count fruit – precision thinning
  increase % of larger fruit
  increase % of higher quality fruit
  minimize alternate bearing
  – yield estimation
    increase harvest efficiencies
    profit from better marketing strategies
    reduce cold storage issues

Canopy management – year to year consistency in yields

Fertility management – precision application of N₂

Water management – water is the current conflict between agriculture and non-agricultural populations

How much does it cost?

Cost Minimizer
How much does it cost?

Cost Minimizer

What benefits can I expect to receive?

Profit Maximizer

The Profit Maximization Concept:

Suggests that You Will Invest Money on Inputs to Increase Revenues as Long as the Incremental Revenues are Over and Above the Incremental Costs!
Law of Diminishing Returns

Cost Minimization vs. Profit Maximization

Output of Corn vs. Units of Nitrogen

Cost Minimization vs. Profit Maximization

Production Function

$0 + $10 + $12 + $9 + $6 + $3 + $0 = $45
Capital Investment Analysis

A budgeting procedure that assesses the potential profitability of a long-term investment.

Financial Concepts used to Evaluate Investments

- Net Present Values (NPV)
- Internal Rate of Return (IRR)
- Break-even Year to Cash Flow

Key Factors in Mechanization of Pear Harvest

- Return to the Grower
- Cost of Mechanized Machine
- Single Pick (bins harvested per hour)
- Mix of Varieties over Harvest Season
- Training System (field efficiency)
- Total Harvested Acres per Machine
Key Factor in Any Equipment Investment Analysis

Field Capacity (Efficiency)

Field efficiency is defined as the percentage of time the machine operates at its full rated speed and width while in the field.

*Turning and idle travel;*
*Operating at less than full width;*
*Handling fertilizer, chemicals, water or harvested materials;*
*Cleaning clogged equipment;*
*Maintenance;*
*Lubrication and refueling during the day;*
*Waiting for other machines;*
*Waiting for repairs to be made.*

Field Efficiency In Other Agricultural Field Operations

<table>
<thead>
<tr>
<th>Field efficiency</th>
<th>Range (%)</th>
<th>Typical (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tillage &amp; planting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moldboard plow</td>
<td>70-90</td>
<td>85</td>
</tr>
<tr>
<td>Heavy-duty disk</td>
<td>70-90</td>
<td>85</td>
</tr>
<tr>
<td>Row crop planter</td>
<td>50-75</td>
<td>65</td>
</tr>
<tr>
<td>Grain drill</td>
<td>55-80</td>
<td>70</td>
</tr>
<tr>
<td>Harvesting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corn picker sheller</td>
<td>60-75</td>
<td>65</td>
</tr>
<tr>
<td>Combine</td>
<td>60-75</td>
<td>65</td>
</tr>
<tr>
<td>Mower</td>
<td>75-85</td>
<td>80</td>
</tr>
<tr>
<td>Mower (rotary)</td>
<td>75-90</td>
<td>80</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fertilizer spreader</td>
<td>60-80</td>
<td>70</td>
</tr>
<tr>
<td>Boom-type sprayer</td>
<td>50-80</td>
<td>65</td>
</tr>
</tbody>
</table>

Source: ASAE standards, 2004
Key Factor in Any Equipment Investment Analysis

**Acres per Hour**

\[
\text{Equipment Speed} \times \text{Width of Field} \times \text{Operation Efficiency} = 8.25
\]

(relationship of rods in a mile and square feet per acre)

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**Estimated Acres per Hour for Mechanical Harvest Operation**

\[
1.0 \text{ mph} \times 12 \text{ feet} \times 30\% = 0.44 \text{ Ac/Hr}
\]
Estimated Acres per Hour for Mechanical Harvest Operation

0.44 acres per hour
\[ \times \] 20 hours per day
8.80 acres/day
\[ \times \] 25 days of harvest
220 total acres per season

<table>
<thead>
<tr>
<th>MPH</th>
<th>Field Efficiency</th>
<th>Acres/ Hour</th>
<th>Total Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>30%</td>
<td>0.44</td>
<td>220</td>
</tr>
<tr>
<td>1.5</td>
<td>30%</td>
<td>0.65</td>
<td>325</td>
</tr>
<tr>
<td>1.0</td>
<td>40%</td>
<td>0.58</td>
<td>290</td>
</tr>
<tr>
<td>1.5</td>
<td>40%</td>
<td>0.87</td>
<td>435</td>
</tr>
<tr>
<td>1.0</td>
<td>50%</td>
<td>0.73</td>
<td>365</td>
</tr>
<tr>
<td>1.5</td>
<td>50%</td>
<td>1.09</td>
<td>545</td>
</tr>
<tr>
<td>1.0</td>
<td>60%</td>
<td>0.87</td>
<td>435</td>
</tr>
<tr>
<td>1.5</td>
<td>60%</td>
<td>1.31</td>
<td>655</td>
</tr>
</tbody>
</table>
Bi-axe planting in Chelan, with 55 Bin per Acre crop in 2013
Establishing a New Pear Orchard, 1,089 TPA, 12’ Centers
Begin Prod. in Year 3, Full Prod. w/ 65 BPA in Year 6, $300/Bin

Net Present Value $22,842
(8% Discount Rate)
Establishing a New Pear Orchard, 1,089 TPA, 12’ Centers
Begin Prod. in Year 3, Full Prod. w/ 65 BPA in Year 6, $300/Bin

- $400,000 for a Mechanical Harvester Machine
- Spread Costs over 100 acres for a $4,000 per acre cost
- Life of Machine is 10 Years (obsolesce/depreciated)
- Replace Machine in 10 Years
- Purchase Mechanical Harvester in Year 4 & 14
- Salvage Value of $40,000 in Year 13 & $100,000 in Year 20
- Maintenance & Repairs = 5% of purchase price ($200/acre)
- All costs are inflated at 3% annually

Hand Harvest
Net Present Value ($22,842)
(8% Discount Rate)

Mechanized Harvest
Net Present Value ($29,935)
Establishing a New Pear Orchard, 1,089 TPA, 12’ Centers
Begin Prod. in Year 3, Full Prod. w/ 65 BPA in Year 6, $300/Bin

<table>
<thead>
<tr>
<th>Year</th>
<th>Hand Harvest</th>
<th>Machine</th>
<th>W/P &amp; T</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>$22,842</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>$29,935</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td>$31,533</td>
</tr>
</tbody>
</table>

(8% Discount Rate)

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Takeaways
✓ Technology (i.e. AUV’s) will benefit fruit producers more than any other sector in agricultural (high input-high output; market product by size and grade characteristics)
✓ With that said, not all pear blocks will benefit from precision technologies equally, more will benefit than others (yields, varieties, packout, training system)
✓ It is critical to know your production, packout and input costs on a block-by-block basis to allocate resources to those blocks that will generate the most profits
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Takeaways

✓ Returns to the Grower is still #1
✓ Do not focus on the cost of mechanized machine!
✓ Focus on bins harvested per hour
✓ Mix of varieties over harvest season, key to maximizing the capacity of the machine
✓ The training system is key to field efficiency, which impacts the total harvested acres per machine